MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023 (TERM ID 2220)

DCP5301 – DATA STRUCTURE AND ALGORITHMS

(All sections / Groups)

10 JULY 2023
2.30 p.m – 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question Paper consists of 6 pages including cover page.
2. There are 8 questions. Answer ALL questions. The distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

There are EIGHT (8) questions. Answer ALL questions. Total is 60 marks.

QUESTION 1 [5 Marks]

a) Explain the two parts: data structure and algorithm. [1 mark]

b) Provide examples of both primitive and non-primitive data structures and describe the differences between them. [2 marks]

c) Explain the importance of using different data structures. [1 mark]

d) Describe the process of selecting data structure. [1 mark]

QUESTION 2 [5 Marks]

a) Evaluate the following postfix notation. Write the infix notation and calculate the final result. [1 Mark]

Postfix : 18 3 / 2 ^ 13 7 + 5 2 ^ * +

b) Evaluate the following prefix notation. Write the infix notation and calculate the final result. [1 Mark]

Prefix : + + 10 10 + * 2 2 ^ 9 2

c) Referring to Figure 1, given is an empty array. Y is a queue that can store four integers and Z is a stack that can store six integers. T and W are variables that store values 4 and 3 respectively. Trace and draw the content of Y, Z, T and W after each of the following operations/codes are executed. Drawing must clearly show the content of Y, Z, T and W for each of the code execution. [3 Marks]

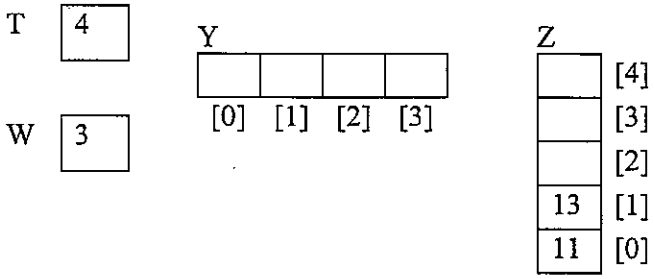

Figure 1

Continued .....

i.
```
Z.push(T-W);
```

ii.
```
Y.append(W+Z.pop());
```

iii.
```
if(Y.serve() < W)
     Z.push(T * W2);
else
     Y.append(T-W);
```

QUESTION 3 [6 Marks]

Table 3.1 represents an array implementation of a linked list.

Index	Data	Link
0	63	
1	77	
2	33	
3	44	
4	55	
5	22	
6	52	
7	88	

Table 3.1

i. Taking 0 as the start of the list and 99 as a dummy representing the end of the file, fill in the link for all the elements in table to maintain a list of the following order.[4 Marks]

63 33 22 52 88 77 55 44

ii. Based on the answer in question 3(i), draw an updated table after data 40 is added between data 22 and 52. [2 marks]

Continued .....

QUESTION 4 [4 Marks]

Using **binary search algorithm**, show step by step on how to find data with value 45 in the array in Figure 4. Write the value of **middle**, **first** and **last** in each steps. [4 Marks]

85	75	65	55	45	35	;25	15
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]

Figure 2

QUESTION 5 [6 Marks]

a) Determine the order of the following unsorted list using Merge sort. [3 Marks]

248	123	554	324	887	453	653	702	980
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]

Figure 3

b) Referring to array in Figure 4, show step by step to sort the data to **ascending** order using **Insertion Sort** algorithm. [3 Marks]

5	4	16	7	10	12	1

Figure 4

Continued .....

QUESTION 6 [15 Marks]

a) Describe "hashing". Then briefly explain Linear Probing and Quadratic Probing in hash tables. [5 marks]

b) Assume a hash table with ten (10) locations and the hashing function **h(x) = x%10**. Calculate the index for each key and the result of the hash table when the following integers are inserted in the order given : **61, 43, 84, 30, 92, 73, 55, 63, 77.** Show all the necessary calculation clearly in your answer. If collision occurs, resolve the clashing using **Quadratic Probing.**

[10 Marks]

QUESTION 7 [9 Marks]

Given the following list of data : **60, 45, 80, 35, 50, 70, 90, 65, 75, 85**

a) Draw a binary search tree. [5 Marks]

b) Based on the tree that you have drawn in Question 7(a) answer ALL of the following questions:

i. Write the preorder traversal for node with data 80. [1 Mark]

ii. Redraw the tree when node with data 80 is being deleted. [1 Mark]

iii. What is the height of the tree based on the new redrawn tree in Question 7(b)(ii)? [1 Mark]

iv. Which node will be the root node if data 80 is deleted? [1 Mark]

Continued .....

QUESTION 8 [10 Marks]

a) Draw graph based on the adjacency matrix given in Figure 5. [5 Marks]

	A	B	C	D	E
A	0	1	4	0	0
B	0	0	0	5	1
C	0	0	0	8	0
D	7	0	0	0	1
E	8	0	0	0	0

Figure 5

b) Based on your drawn graph in Question 8(a), answer all of the following questions :

i. What is the type of graph drawn? [1 Mark]

ii. State how many cycle(s) you can identify from the graph. Write the length and cycle path. [2 Marks]

c) Based on graph in Figure 6, write the graph traversal for **Depth First Search** and **Breadth First Search** starting at vertex **A.** [2 Marks]

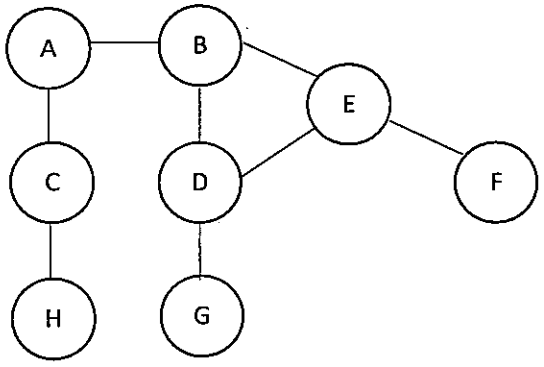

Figure 6

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